

CLAIM AMENDMENTS

1. (Currently Amended) An apparatus comprising:

a first end-fire array comprising a first microphone configured for outputting a first microphone signal, and a second microphone configured for outputting a second microphone signal;  
a second end-fire array comprising a third microphone configured for outputting a third microphone signal, and a fourth microphone configured for outputting a fourth microphone signal;  
~~a first channel spatial filter, wherein a first input signal and a second input signal are input to said first channel spatial filter configured for receiving said first and second microphone signals, and wherein for outputting a first output signal is output by said first channel spatial filter;~~  
~~a second channel spatial filter, wherein a third input signal and a fourth input signal are input to said second channel spatial filter configured for receiving said third and fourth microphone signals, and wherein for outputting a second output signal is output by said second channel spatial filter; and~~  
~~a binaural spatial filter, wherein configured for receiving said first and second output signals are input to said binaural spatial filter and wherein a for outputting a first channel output signal is and a second channel output signal without separating each of said first and second output signals into low and high frequency spectrum portions output by said binaural spatial filter and a second channel output signal is output by said binaural spatial filter.~~

2-3. (Cancelled).

4. (Currently Amended) The apparatus of claim 1, wherein said apparatus is a hearing aid, wherein said first ~~microphone and said~~ and second microphones are configured for being placed proximate to a user's left ear, and wherein said third ~~microphone and said~~ and fourth microphones are configured for being placed proximate to a user's right ear.

5. (Currently Amended) The apparatus of claim 1, An apparatus comprising:  
a first channel spatial filter configured for receiving a first input signal and a second input  
signal and for outputting a first output signal;  
a second channel spatial filter configured for receiving a third input signal and a fourth input  
signal and for outputting a second output signal; and  
a binaural spatial filter configured for receiving said first and second output signals and for  
outputting a first channel output signal and a second channel output signal;  
wherein one of said first and second channel spatial filters further comprises:  
a first fixed polar pattern unit, ~~said first fixed polar pattern unit~~ configured for  
outputting a first unit output;  
a second fixed polar pattern unit, ~~said second fixed polar pattern unit~~ configured for  
outputting a second unit output; and  
a first combining unit comprising a first adaptive filter, ~~wherein said first combining~~  
~~unit receives and configured for receiving said first and second unit outputs and said second unit~~  
~~output, and wherein said first combining unit outputs for outputting said first output signal.~~

6. (Currently Amended) The apparatus of claim 5, wherein the other of said first and second  
channel spatial filters further comprises:  
a third fixed polar pattern unit, ~~said third fixed polar pattern unit~~ configured for  
outputting a first unit output;  
a fourth fixed polar pattern unit, ~~said fourth fixed polar pattern unit~~ configured for  
outputting a second unit output; and  
a second combining unit comprising a first adaptive filter, wherein said first  
combining unit ~~receives is configured for receiving~~ said first and second unit outputs and said

~~second unit output, and wherein said first combining unit outputs for outputting said first output signal.~~

7-8 (Cancelled)

9. (Currently Amended) The apparatus of claim 1, An apparatus comprising:  
a first channel spatial filter configured for receiving a first input signal and a second input  
signal and for outputting a first output signal;  
a second channel spatial filter configured for receiving a third input signal and a fourth input  
signal and for outputting a second output signal; and  
said a binaural spatial filter further comprising:  
a first combining unit, wherein said first combining unit combines configured for  
combining said first and second output signals and outputs for outputting a reference signal;  
a first adaptive filter, said first adaptive filter configured for receiving said reference  
signal and outputting a first adaptive filter output;  
a second combining unit, wherein said second combining unit combines configured  
for combining said first output signal with a said first adaptive filter output, and wherein said second  
combining unit outputs said and for outputting a first channel output signal;  
a second adaptive filter, said second adaptive filter configured for receiving said  
reference signal and outputting a second adaptive filter output; and  
a third combining unit, wherein said third combining unit combines configured for  
combining said second output signal with a said second adaptive filter output, and wherein said  
second combining unit outputs said and for outputting a second channel output signal.

10-11. (Cancelled)

12. (Currently Amended) A hearing aid, comprising:

a first microphone configured for outputting a first microphone signal;

a second microphone configured for outputting a second microphone signal, wherein said first and second microphones are configured for being positioned as a first end-fire array proximate to a user's left ear;

a third microphone configured for outputting a third microphone signal;

a fourth microphone configured for outputting a fourth microphone signal, wherein said third and fourth microphones are configured for being positioned as a second end-fire array proximate to a user's right ear;

a left spatial filter, ~~said left spatial filter~~ comprising:

a first fixed polar pattern unit, ~~said first fixed polar pattern unit~~ configured for outputting a first unit output;

a second fixed polar pattern unit, ~~said second fixed polar pattern unit~~ configured for outputting a second unit output; and

a first combining unit comprising a first adaptive filter, ~~wherein said first combining unit receives and configured for receiving~~ said first unit output and ~~said and~~ second unit outputs; and ~~wherein said first combining unit outputs for outputting~~ a left spatial filter output signal.

a right spatial filter, ~~said right spatial filter~~ comprising:

a third fixed polar pattern unit, ~~said first fixed polar pattern unit~~ configured for outputting a third unit output;

a fourth fixed polar pattern unit, ~~said second fixed polar pattern unit~~ configured for outputting a fourth unit output; and

a second combining unit comprising a second adaptive filter, ~~wherein said second combining unit receives and configured for receiving~~ said third unit output and ~~said and~~ fourth unit

~~outputs; and wherein said first combining unit outputs for outputting~~ a right spatial filter output signal.;

a binaural spatial filter, ~~said binaural spatial filter comprising:~~

~~a third combining unit, wherein said third combining unit combines configured for combining~~ said left spatial filter output signal and said right spatial filter output signal and ~~outputs for outputting~~ a reference signal;

~~a third adaptive filter, said third adaptive filter configured for receiving~~ said reference signal;

~~a fourth combining unit, wherein said fourth combining unit combines configured for combining~~ said left spatial filter output signal with a third adaptive filter output, ~~and wherein said fourth combining unit outputs and for outputting~~ a left channel output signal;

~~a fourth adaptive filter, said fourth adaptive filter configured for receiving~~ said reference signal; and

~~a fifth combining unit, wherein said fifth combining unit combines configured for combining~~ said right spatial filter output signal with a fourth adaptive filter output, ~~and wherein said fifth combining unit outputs and for outputting~~ a right channel output signal;

~~a first output transducer, said first output transducer configured for converting~~ said left channel output signal to a left channel audio output; and

~~a second output transducer, said second output transducer configured for converting~~ said right channel output signal to a right channel audio output.

13. (Original) A method of processing sound, comprising the steps of:

receiving a first input signal from a first microphone;

receiving a second input signal from a second microphone;

providing said first and second input signals to a first fixed polar pattern unit;

providing said first and second input signals to a second fixed polar pattern unit;

adaptively combining a first fixed polar pattern unit output and a second fixed polar pattern unit output to form a first channel binaural filter input;

receiving a third input signal from a third microphone;

receiving a fourth input signal from a fourth microphone;

providing said third and fourth input signals to a third fixed polar pattern unit;

providing said third and fourth input signals to a fourth fixed polar pattern unit;

adaptively combining a third fixed polar pattern unit output and a fourth fixed polar pattern unit output to form a second channel binaural filter input;

combining said first channel binaural filter input and said second channel binaural filter input to form a reference signal;

adaptively combining said reference signal with said first channel binaural filter input to form a first channel output signal; and

adaptively combining said reference signal with said second channel binaural filter input to form a second channel output signal.

14. (Original) The method of claim 13, further comprising the steps of:

converting said first channel output signal to a first channel audio signal; and

converting said second channel output signal to a second channel audio signal.

15. (Original) The method of claim 13, wherein said step of adaptively combining said first fixed polar pattern unit output and said second fixed polar pattern unit output to form said first channel binaural filter input further comprises the step of varying a first gain value to position a first null corresponding to said first channel binaural filter input, and wherein said step of adaptively

combining said third fixed polar pattern unit output and said fourth fixed polar pattern unit output to form said second channel binaural filter input further comprises the step of varying a second gain value to position a second null corresponding to said second channel binaural filter input.

16. (Original) The method of claim 13, wherein said steps of adaptively combining utilize an LS algorithm.

17. (Currently Amended) The method of claim 13, wherein said steps of adaptively combining utilize one of an RLS algorithm, TLS algorithm, NLMS algorithm, and LMS algorithm.

18-20. (Cancelled)

21. (New) The apparatus of claim 1, further comprising:

a first output transducer configured for converting said first channel output signal to a first channel audio output; and

a second output transducer configured for converting said right channel output signal to a second channel audio output.

22. (New) The apparatus of claim 5, further comprising first, second, third, and fourth microphones configured for respectively outputting said first, second, third, and fourth input signals.

23. (New) The apparatus of claim 22, wherein said first microphone and said second microphone are positioned in a first end-fire array and wherein said third microphone and said fourth microphone are positioned in a second end-fire array.

24. (New) The apparatus of claim 22, wherein said apparatus is a hearing aid, wherein said first and second microphones are configured for being placed proximate to a user's left ear, and wherein said third and fourth microphones are configured for being placed proximate to a user's right ear.

25. (New) The apparatus of claim 22, further comprising:

a first output transducer configured for converting said first channel output signal to a first channel audio output; and

    a second output transducer configured for converting said right channel output signal to a second channel audio output.

26. (New) The apparatus of claim 9, further comprising first, second, third, and fourth microphones configured for respectively outputting said first, second, third, and fourth input signals.

27. (New) The apparatus of claim 26, wherein said first microphone and said second microphone are positioned in a first end-fire array and wherein said third microphone and said fourth microphone are positioned in a second end-fire array.

28. (New) The apparatus of claim 26, wherein said apparatus is a hearing aid, wherein said first and second microphones are configured for being placed proximate to a user's left ear, and wherein said third and fourth microphones are configured for being placed proximate to a user's right ear.

29. (New) The apparatus of claim 26, further comprising:

    a first output transducer configured for converting said first channel output signal to a first channel audio output; and

    a second output transducer configured for converting said right channel output signal to a second channel audio output.